

## MATHEMATICAL TEXT-BOOKS.

- (1) *Elements of the Differential and Integral Calculus.* By Prof. A. E. H. Love, F.R.S. Pp. xiv+208. (Cambridge: University Press, 1909.) Price 5s.
- (2) *Plane Trigonometry. An Elementary Text-book for the Higher Classes of Secondary Schools and for Colleges.* By Prof. H. S. Carslaw. Pp. xviii+293+xi. (London: Macmillan and Co., Ltd., 1909.) Price 4s. 6d.
- (3) *Elementary Projective Geometry.* By A. G. Pickford. Pp. xii+256. (Cambridge: University Press, 1909.) Price 4s.
- (4) *A First Course in Analytical Geometry, Plane and Solid, with Numerous Examples.* By C. N. Schmall. Pp. viii+318. (London: Blackie and Son, Ltd., 1909.) Price 6s. net.

(1) THIS book is founded on lectures delivered by Prof. Love at Oxford to students of applied sciences. The object, both of the book and of the lectures, is to encourage the study of the Calculus amongst a wider circle than has been commonly the case hitherto. To quote from Prof. Love's preface:—

"The principles of the Differential and Integral Calculus ought to be counted as a part of the heritage of every educated man or woman in the twentieth century, no less than the Copernican system or the Darwinian theory. In order to make a beginning no previous knowledge of mathematics is needed beyond the most elementary notions of geometry, a little algebra, including the law of indices, and the definitions of the trigonometric functions."

The more difficult theorems on limits which are needed have been proved with considerable detail, but the proofs are placed in appendices so as to avoid discouraging the beginner. The most novel of these is the very complete and satisfactory discussion of the length of an arc of a circle (App. v.); but it seems a pity that the same method was not carried on (in App. vi.) to obtain the limits of  $\sin a/a$  and  $\tan a/a$  (as  $a$  tends to zero) instead of following the more intuitive method which is given in most text-books.

With the aim and methods of Prof. Love's book we are in hearty sympathy; our sole criticism would refer to the difficult problem of treating the logarithmic function, about which opinions will probably always differ. In conclusion, we may refer to the welcome practice of reducing definite integrals to numbers, in suitable cases, instead of stopping at analytical formulæ; it is very instructive to beginners to compare the result of such a calculation with the value found from a graph, by estimating its area roughly.

(2) The earlier part of this book is based upon lectures delivered by Prof. Carslaw to first-year pass classes, first at Glasgow and afterwards at Sydney. Very good graphs of the trigonometrical functions, direct (pp. 60-2) and inverse (pp. 205-8), including the less familiar functions, such as  $\sec x$  and  $\sec^{-1}x$ , will be found in the book; and a set of four-figure tables is given at the end of the book. While welcoming the spread of these tables, it seems a pity that more modern tables (in tenths and hundredths of degrees) were not used instead of Bottomley's forms.

The second part of the book, on analytical trigonometry, is less completely handled, proofs of the more

difficult theorems (such as the power-series for  $\sin x$  and  $\cos x$ , the product for  $\sin x$ ) being outlined only, without any attempt at rigorous investigations.

A few notes of difficulties may be added, in view of later editions. In discussing the limit of  $\sin \theta/\theta$  as  $\theta$  tends to zero (§ 92) it is assumed that the length of a circular arc is less than the sum of the tangents drawn at its extremities. Although this assumption is natural enough in a purely intuitive discussion, yet, after having given an arithmetic definition of length in §§ 89, 90, it would be only reasonable to deduce the theorem in question from the definition.

When discussing the solution of trigonometrical equations, it seems strange that no use is made of the substitution  $t = \cos \theta + i \sin \theta$ ; and the more so since all the examples solved in the book (§ 136) can be more easily treated by this substitution than by any other.

In § 148 the convergence of the series  $\sum a_n \cos n\theta$ ,  $\sum a_n \sin n\theta$  is treated graphically by the aid of a spiral polygon. This method is interesting on account of its applications in physical optics, leading up to the graphical treatment of diffraction-integrals by a smooth spiral curve (such as Cornu's spiral); but it is not quite obvious where the geometrical discussion introduces the condition  $a_n > a_{n+1}$ . It would be helpful to give an algebraical treatment as well, following the classical methods of Abel and Dirichlet, from which the essential character of the condition  $a_n > a_{n+1}$  is at once evident.

Prof. Carslaw's book may be heartily recommended to anyone wishing for a good knowledge of elementary trigonometry, together with a first introduction to more advanced methods.

(3) It is not easy to estimate the effect which a geometrical text-book will produce on a beginner; and we have had no opportunity of testing this particular book in actual teaching. But on a first reading the arrangement adopted seems less satisfactory than in several existing books: in a course on *projective geometry*, the method of *projection* should take a prominent part, and not be left until the last chapter in the book. There is a tendency also to give a variety of proofs of theorems which are really all special cases of one general theorem (such as Pascal's or Brianchon's), and this helps to make the book longer, without making it any easier to read.

Two details may perhaps be criticised: the idea of *involution* is introduced very early, before defining projective ranges on the same line; but in actual teaching it is generally found easier to define involution as a special type of homography. Also the pole-locus of a line with respect to a system of four-point conics is called the *nine-point conic*, instead of the *eleven-point conic*; the latter term is now generally adopted, and the reason for the change is not obvious.

It seems to us that there is some need for a book on projective geometry which makes occasional use of analytical methods—in fact, a book written more on the lines of the second half of Salmon's "Conics"—and a really useful addition would be some plates of drawings, on a fairly large scale, showing the actual construction of conics by means of pencil and ruler, in various ways.

(4) There is but little to distinguish the present

text-book from those in common use already. We note the usual unfortunate preference for the equation  $y=mx+c$  to represent a straight line, instead of the homogeneous form  $lx+my+n=0$ . As a natural consequence, we find the equations  $y=mx+\sqrt{(a^2m^2+b^2)}$ ,  $y=mx+a/m$ , for the tangents to an ellipse and parabola respectively; and we are still left to wonder why no teacher has the courage to write an elementary text-book which uses the tangential equations  $a^2l^2+b^2m^2=n^2$ ,  $ln-am^2=0$ .

The chief innovation consists in a short chapter (xii., pp. 241-57) on higher plane curves, such as the cissoid, conchoid, lemniscate, cycloid, and some of the simpler polar curves; but as no Calculus is used, nearly all their more interesting properties have to be omitted, and it seems doubtful if the mere tracing of the curves is of sufficient interest to justify their introduction here. We should have preferred to see this space devoted to an extension of the chapters on solid geometry, which occupy only 30 pages, and are too brief to be of much service to beginners.

T. J. I'A. B.

#### SCHLICH'S MANUAL OF FORESTRY.

*Schlich's Manual of Forestry.* Vol. ii.: Silviculture. By Sir Wm. Schlich, K.C.I.E., F.R.S. Fourth edition, revised. Pp. ix+424. (London: Bradbury, Agnew and Co., Ltd., 1910.)

THIS book is a decided advance on the first edition of Schlich's "Silviculture," and a considerable amount of new matter has been added.

Probably the original intention of Schlich's "Manual" was to provide a text-book on the general principles of forestry adapted to the needs of Indian and Colonial forest officers. While this object is still met, the author has evidently made an effort (and we think successfully) to adapt the work better to British needs than was the case in earlier editions.

To accomplish this successfully is not perhaps the easy task many might imagine. It is true the principles of forestry are the same over all, but details in practice must of necessity vary, and climatic differences also tend to modify the relative silvicultural value of various species of trees for any country, or even for districts of a country.

The book is divided into four parts: part i. deals with what the author designates "The Foundations of Silviculture." Here we have a full discussion of such matters as climate, soils, effects of forest vegetation on locality; development of forest trees; character and composition of woods; advantages and disadvantages of mixed woods; and rules for forming pure and mixed woods. The various silvicultural systems are also described in detail.

Part ii. is concerning the "Formation and Regeneration of Woods." Fencing, soil preparation, sowing, planting, and tree nursing management are fully treated. Under this head also the various modern methods of natural regeneration are described.

Part iii. deals with the tending of woods throughout the various stages, from early youth to maturity.

Of part iv. ninety pages are devoted to

a brief discussion of the silvicultural characters of British forest trees. Under the convenient title of "British Forest Trees" the author includes several recently introduced species, some of which are certainly of doubtful utility for British conditions, as, e.g., American *Black Walnut* and *Black Cherry*. He wisely refrains, however, from definitely recommending such species for general planting.

The book is well illustrated. Although some of the illustrations are necessarily diagrammatic in character, they are none the less valuable to students on that account.

Schlich's "Silviculture" continues to hold its own as one of the chief standard works on the subject, and should be in the hands of all students of forestry.

J. F. A.

#### GENERAL BIOLOGY.

*General Biology: a Book of Outlines and Practical Studies for the General Student.* By Prof. James G. Needham. Pp. xiv+542. (Ithaca, N.Y.: The Comstock Publishing Co., 1910.) Price 2 dollars.

WE have long felt that if biology is ever to take the place which it undoubtedly should in our educational system, there will have to be some radical reform in the manner in which it is taught, or perhaps it would be more correct to say in the selection of those portions of the subject which are to be taught. The type-system, excellent as it is in many respects, has had far too much influence on biological curricula, and the over-specialisation in zoology and botany has resulted in a general neglect of those general principles which are the life-blood of both. Fortunately, signs are not wanting of a widespread striving towards a more rational treatment of the subject, and in this respect the Americans appear to be taking the lead. The work before us, modestly described by its author as "A Book of Outlines and Practical Studies for the General Student," strikes us as being delightfully refreshing and original. Its scope is, perhaps, almost too comprehensive. There are only seven chapters, but they are very long ones. In the first, the interdependence of organisms is illustrated by the relations between flowers and insects; galls, and the relation between ants and aphids. The second deals with the simpler organisms, illustrated by typical algæ and protozoa. The third is devoted to organic evolution, with a brief account of the animal and vegetable series and the general principles of the subject. The fourth discusses inheritance; the fifth the life-cycle; the sixth the adjustment of organisms to environment; and the seventh the responsive life of organisms.

A leading feature of the book is a set of practical exercises at the end of each chapter. These are extraordinarily varied and interesting, and well calculated to impart a real vitality to the subject, though perhaps some of them, such as the observations on the internal metamorphosis of insects, are rather too specialised.

The illustrations are excellent and to a large extent novel, and the portraits of Schultze, Pasteur, Von Baer, I innæus, Agassiz, Darwin, Leeuwenhoek,